SOME PHYSIOLOGICAL ASPECTS OF THE SKELETAL AND MUSCULAR SYSTEMS OF LISSEMYS

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Bone which forms the frame work of the body of vertebrates is basically a type of connective tissue consisting of branched cells within a matrix hardened by the deposition of a complex material composed chiefly of calcium, phosphate and carbonate. Owing to its high degree of specialization bone shows marked differences in cellular constitution from other connective tissues.

The main bulk of the solid part of bone is formed by three substances namely the bone mineral, a fibrillar protein, collagen and an amorphous ground substance, characterised by its polysaccharide components. While an extensive data on the chemical composition of the mammalian bone is available, I have not been able to obtain such information regarding the reptilian bone.

The purpose of the present study has been therefore to estimated the gross chemical composition and the calcium and phosphorus contents of the long bone and compare with that of the carapace of the

adult as well as the young turtle.

George (1947 and '52) gave the gross chemical composition of the skeletal muscle of representative types from the five classes of vertebrates and indicated an evolutionary trend in the variations. In the present study it was thought desirable to estimate the gross chemical composition and also the iron and phosphorus contents of the thigh muscle of the freshwater, terrestrial and amphibious chelonians and compare these figures with those of the lizard and frog.

Material and Methods:

The common Indian pond turtle Lissemys punctata was chosen for these investigations. The shaft of the humerus and the femur were used for the study of long bones and pieces of the carapace devoid of the rib part only were taken for the carapace. The weight of the animal was taken as an indication of its age.

The chelonians chosen were the freshwater form Trionyx gangeticus, the terrestrial Testudo elegans, the amphibious Lissemys puncatata and the more terrestrial than aquatic Geomyda trijuga.

The water content was estimated by the dehydration method by heating in an oven at 105°C. The protein content was obtained by the Kjeldahl's distillation method, fat by soxhlet extractions using a 1 : 3 alcohol ether mixture, ash by ashing in a muffle furnace at dull red heat and the carbohydrate by difference. The calcium content was obtained according to the method given in A.O.A.C. 6.13 and the phosphorus by the mehtod of Fisk and Subbarow. Iron content was estimated by the method of Kennedy.

Results:

Vide tables 1 & 2 and histograms 1 & 2

Discussion:

In a more or less fully grown Lissemys nearly 45 % of the long bone and 25 % of the carapace consists of water, whereas in the smallest ones I have examined weighing 40 to 50 gms. the water contents of the long bone and carapace are 50 % and 85 % respectively. These results show that the water content of carapace is nearly half of that of the long bone with the percentage of the solid content correspondingly higher in a full grown turtle and that with increase in age the water content gets diminished.

In a full grown turtle the protein contents of the carapace and the long bone are more or less the same but in the young one (40 - 50 gm.) the protein content of the former is considerably less while that of the latter is the same as that of the adult. As growth proceeds the fluctuations in the protein content in the long bone are very slight and so there is no reason to belive that the protein content of the carapace is built up at the cost of the same in the long bone.

Regarding the ash content, the long bone of an

adult animal has only 4 % more than that of a young one (40 - 50 gm.). But the ash content of the carapace in the young is negligible but in the adult it is as high as 51 %. This shows that taking the various constituent salts as a whole there is not any visible transport of such material from the long bone to the carapace.

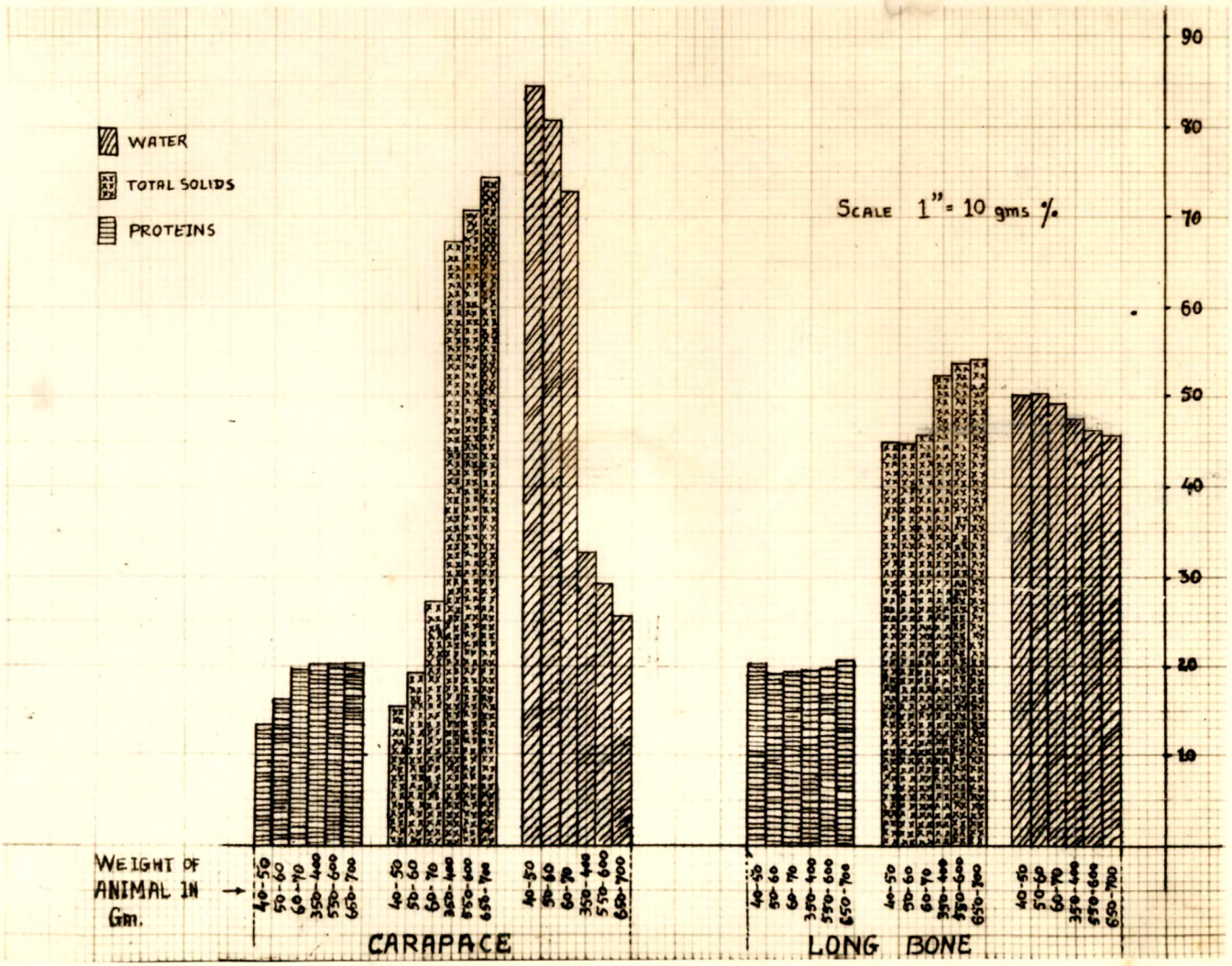
The calcium to phosphorus ratio obtained for the adult long bone is 6:1 which is the same for the adult carapace also. In the case of the young one the ratio is nearly 10:1 for the long bone whereas for the carapace the calcium and the phosphorus contents are negligible. It therefore seems evident that considerable amount of calcium is transported from the long bones to the carapace and that the long bones are a store-house of calcium.

The fat and carbohydrate figures are more or less constant in all cases and so no comments are necessary.

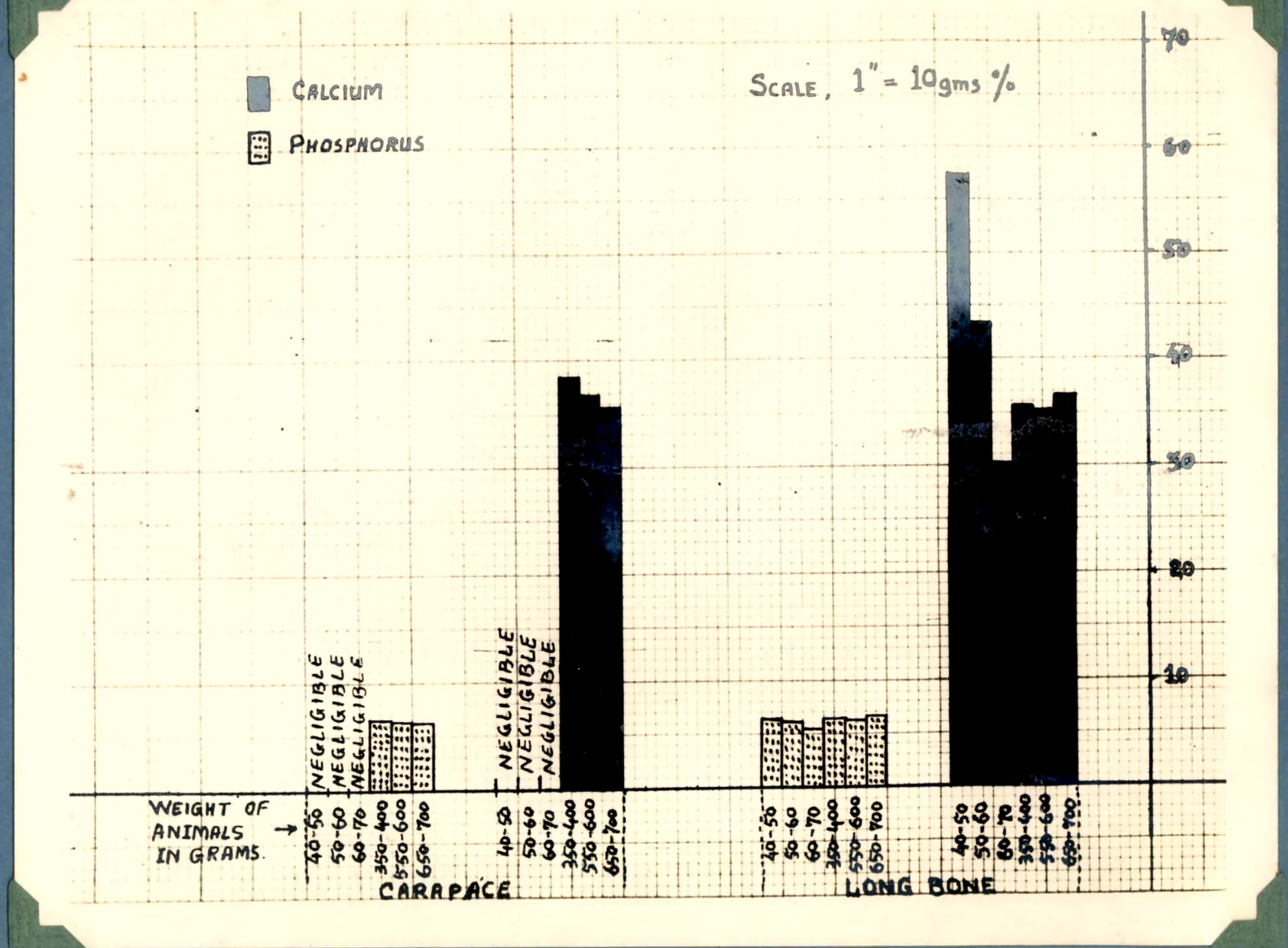
The figures obtained for water, total solids, fat, protein, ash and carbohydrate contents for Lissemys and Trionyx thigh muscle are more or less the same and

those for Geomyda and Testudo are almost the same. Those of Lissemys and Trionyx tally with those of the frog denoting thereby that these two chelonians are secondarily adapted to a life in water. On the other hand the figures for the terrestrial forms tally with those of the lizard which shows that they are adapted to a life on land.

The muscle of Lissemys and Trionyx show a higher iron content than that of Geomyda and Testudo. This is so because the former two being more active forms than the latter ones, their muscle should be having a higher myoglobin content which is denoted by a higher iron figure. The higher phosphorus figure in the muscle of Testudo and Geomyda is perhaps due to the fact that these chelonians possess a more massive body shell than that of Lissemys and Trionyx, in which a considrably larger amount of phosphorus in the form of phosphates is deposited and this is rflected in the muscle phosphorus content.


WATER
TOTAL SOLIDS
PROTEINS
SCALE 1" = 10 gms %
90
80
70
60
50
40
30
20
10
WEIGHT OF ANIMAL IN Gm.
40-50
50-60
60-70
350-400
550-600
650-700
CARAPACE
LONG BONE

HISTOGRAM 1


CALCIUM
PHOSPHORUS
SCALE, 1" = 10gms %
70
60
50
40
30
20
10
NEGLIGIBLE
NEGLIGIBLE
NEGLIGIBLE
NEGLIGIBLE
NEGLIGIBLE
NEGLIGIBLE
WEIGHT OF ANIMALS IN GRAMS.
40-50
50-60
60-70
350-400
550-600
650-700
CARAPACE
LONG BONE

HISTOGRAM 2